

Frequencies VHF, UHF, and SHF Newsletter NZ

This newsletter is compiled by Kevin Murphy ZL1UJG to promote operational and construction activity on the VHF, UHF and SHF Amateur Radio allocations in New Zealand...(and overseas).

Articles for this Newsletter can be sent via email to rfman@extra.co.nz

Post to K Murphy, 8 Tamar Place, Hamilton, New Zealand. Ph 07 8470041

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WSJT now with Tropo/EME and Meteor Scatter modes

The computer program WSJT has now been expanded with separate modes of FSK441 for meteor scatter and JT44 for tropo and EME. The latest version of the program can be downloaded for free at <http://pulsar.princeton.edu/~joe/K1JT/>

In the meteor scatter mode Bob, ZL3TY, has achieved contacts with Rex, VK7MO (1940 km), and Neil, VK2EI (2028 km) on two meters. Bob advises that on six meters the performance on the meteor scatter mode is amazing. In the meteor scatter mode a good rule of thumb is that the maximum distance is 2400 km less 108 km for every degree of obstruction above the horizon at each end. Stations looking for skeds across the Tasman may contact Rex, VK7MO, on Rex.Moncur@bigpond.com.

In its Tropo/EME mode a number of VKs have now completed their first EME contacts on two meters and 600 km terrestrial contacts are being regularly achieved by single yagi 100 watt stations.

Bob, ZL3TY, and a number of VK stations have completed EME QSO's on two meters using the JT44 mode provided with WSJT. Stations with as low as 40 watts and a single 10 element yagi have completed EME QSO's with the super station W5UN.

WSJT BRINGS EME WITHIN THE REACH OF MEDIUM POWER STATIONS

Test Equipment

While writing the last issue I left off a couple of local sources of used test equipment due to some editing. The sources are

www.users.bigpond.com/alandevlin/

<http://electronictrader.webserver.com.au/>

<http://au.user.sold.yahoo.com/au/user/macservice.sold>

<http://listings.ebay.com.au/aw/listings/list/all/category1504>

Contests

Rules are available at <http://www.nzart.org.nz/nzart/update/contests/vhfcontestrules.html>

Logsheets can be downloaded from <http://www.nzart.org.nz/nzart/publicat/logsheets.pdf>

Microwave Contest 2002

614 MHz and up

Saturday October 5th 1600 - 2200 NZT

Sunday October 6th 0800 - 1400 NZT

Beacons

The Hamilton 13 cm Beacon on 2424.256 MHz is running from a location in Northern Hamilton until a more suitable location can be found. The power is +26 dBm (400 mW) and feeds into a double quad antenna pointing towards Mt Pirongia. It is constructed of a G4DDK004 PCB driving a ERA-5 MMIC with single section filter built in waveguide. The PA uses a AT8140 GaAsfet. The AT8140 (1 watt) and AT8160 (400mW) are available surplus from Downeast Microwave at US\$3 and US\$2 respectively. The Era-5 and PA +8 volt supplies are switched via a p-channel FET by an early G4FRE Eprom based keyer thereby providing CW. Dave Robinson, **WW2R** (also G4FRE), has a circuit for a single IC PIC based keyer. <http://ns1.mesh.net/~g4fre/ww2r.htm>

The beacon has had a number of breaks in transmission since starting operation at the temporary site last year. The first failure was as a result of a dry joint in the bias generator and bias circuit design prevented any damage

The second break occurred when it was reported that the PSU smelled possibly due to a capacitor leaking. It was found that the cause was due to a feline leaking. While the PSU was cleaned, the transmitter was put on its final operating frequency and the keying circuit added.

During a local rainstorm the editor listened with an inside antenna pointing towards Mt Pirongia and heard the signal at an increased level due to Rain scatter. The observed signal had a smeared quality peculiar to rain scatter.

There is progress on another 2424 MHz beacon transmitter. This uses an improved G4DDK004 oscillator as described in the previous issue.

If anyone is interested in a beacon transmitter for your local group (on 13 cm and other bands), please contact the editor.

Steve, ZL1TPH in Orewa reports hearing the 1296.275 MHz Wellington Beacon twice this year. Once from Orewa and the other time from Moirs Hill.

The Auckland 432.240 MHz Beacon is received with an 18 element yagi at ~ 10-15 dB signal/noise at the editors location. **Any reports of reception of the ZL1VHW Beacons (Waikato) to the editor via email**

In England the Radio Amateur license allows Personal Beacon Transmitters at home. The operator **must be** in attendance. (i.e. on the premises) when the beacon is active. The personal beacons would probably be for 1296 MHz and above.

TECH NOTES

Frequency Multipliers Tom Bevan, ZL1THG found high order multiplier efficiency with a X 4 transistor multiplier was improved by putting the device in class C mode. (1k5 to ground from base). However it didn't come free, as more RF drive is needed, (+10 - +13 dBm). The multiplier was built on a filter PCB and o/p frequency was 384 MHz.

At lower frequencies the collector is not close to 50 ohms and higher output is achieved by connecting the device to the tap with a small inductor (a few turns at about 2mm diameter) or alternatively connecting the device output to the junction of the stripline and trimmer capacitor. With a transistor (~8 GHz ft) as a doubler to 384 MHz a clean 30 - 40 mW (+15 to +16 dBm) o/p was obtained.

Filter PCB's. Some tests on the filter pcb's using a return loss bridge indicated that the filter PCB's when tuned to 432 MHz and 1152 MHz had return loss figures at resonance of ~ 30 dB. Away from resonance of course the return loss was abysmal at ~ 0 dB.

Homemade trimmer capacitors I found a neat little idea on VK3ZQB's website on using semi rigid cable (.141 ") as part of a trimmer capacitor. The PTFE inner was tapped with 10 BA and brass hardware was used (a M2 screw should work).

Neil VK2EI used these trimmers in a modification to a G4DDK004 oscillator PCB where the output striplines were changed to $\frac{1}{2}$ wave air spaced lines instead of $\frac{1}{4}$ wave printed striplines. The picture to the right shows an example.



G4DDK004 Upgrade Note. (see Issue 4)

For section 3 where the first tuned striplines in TR4 and TR5 collector circuits are grounded, there are 2 cuts in the 1st striplines. The 1st cut is to isolate the collector from the tuned stripline and the second cut is to isolate the grounded end of the 1st stripline from the power feed circuit. The picture points to the general area. The 2 pcb cuts can be done in one motion with a scalpel and metal ruler.

Microwave Newsletters/Magazines

One of the more recent subscribers to this newsletter is Peter Day, G3PHO, editor of the **RSGB MICROWAVE NEWSLETTER** available from the RSGB, www.rsgb.org. The newsletter has excellent technical articles, and is highly recommended. Peter has an excellent website on microwaves at www.g3pho.free-online.co.uk/microwaves/ghz.htm

On the subscribers list also, is Kent Britain, WA5VJB, editor of **FEEDPOINT**, newsletter of the North Texas Microwave Society, www.ntms.org.

Kent also writes the Microwave USA column in **DUBUS**. The DUBUS magazine produced in Germany, has excellent technical articles by the likes of Michael Kuhne, DB6NT and operational information from many stations on different bands. Further information and articles are available at www.dubus.org. In New Zealand and Australia the DUBUS magazine can be subscribed through Doug McArthur, VK3UM, email :- tikaluna@ycs.com.au

Return Loss/ VSWR

I have mentioned VSWR and Return Loss in this newsletter (and previous newsletters). A chart in PDF form can be downloaded from www.wenzel.com/pdf/files/losschrt.pdf. The Wenzel site has other application notes as well.

Microwave Modules 432 - 28 Transverter

I have two versions of the above transverter. One a very early version with no switching and a non recoverable PA section (read smoked) which I purchased off an eminent EME op in the UK some 20 years ago and have used it as testbed. The second unit, which I purchased recently, is the 432-28S version with the PA section intact.

I was able to do some tests, which revealed that the Local Oscillator was -30dB less than the wanted 432 MHz carrier on the output of the main board. The 2RF-LO Product (460 MHz) is -50 dB. A notch filter on the input of the PA board suppressed the oscillator a further 30 dB typically.

It was noticed however that the base DC bias (+0.7 V) on the final PA stage started reducing with ~ 400 mW output and in fact was negative with 10 watts output. It appears that the final stage, due to its non-linearity also acts as a mixer and caused remixing of products. Harmonic suppression is only ~ 30 dB so a lowpass filter is necessary.

Some progress has been made on improving the linearity of the PA section and will document it in a later issue.

The RX RF bandwidth, due to the selectivity of the UHF tuned circuits is pretty measly and results in a rejection of the 376 MHz image by only 10-15 dB.

The Rx side has well over 30 dB of gain with ~ 3.0 dB Noise Figure. As I mentioned earlier I have a testbed transverter and had removed the 2nd stage and used a capacitor between the striplines and it now has about 21 dB gain. This would improve the signal handling. Due to the increase in 2nd stage noise figure (Mixer & IF rather than AMP, Mixer & IF) the overall noise figure increased, but was still less than 4 dB.

There is a review in the RSGB "The Buyers Guide to Amateur Radio" By Angus McKenzie G3OSS. (now out of print, published in 1986) that points out some of the shortcomings. The book is an excellent reference in that it reviews many well known transceivers, amps, transverters and accessories with excellent detail.

Does anyone else have tips on improving the performance of transverters of any band?

Another tip. To improve stability and purity of the Downeast transverters, put a cover over the edge coupled striplines ~ 3 mm above the PCB. The cover is grounded on all sides through the board with wires or veropins spaced 5-10mm apart. The edge coupled filters losses are partly due to radiation (ie they act as antennas)

NEWS FLASH First heard by Pat Gowen G3IOR, on Friday 21st June 2002, Oscar 7 seems to have made a comeback! Pat copied and downloaded CW telemetry. Several AMSAT members confirmed this information as coming from OSCAR-7. This satellite was launched on November 15 1974, giving it a life of 27 and one half years. The receive frequency was 145.9738 MHz.

VK4KZR AMSAT AO-40 satellite system

By Rod Preston VK4KZR

One of my current interests is the new [AMSAT](#) AO-40 satellite. I am active on Mode US and Mode LS, and am looking forward to experimenting with the 2400 MHz uplink, 5668 MHz uplink, as well as the 10450 MHz and 24048 MHz downlinks once they are finally tested and commissioned.

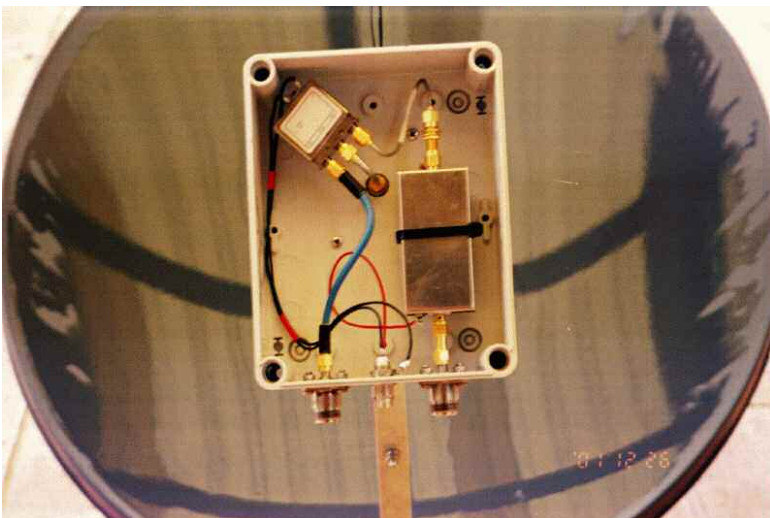
Below is a photograph of my current antenna system which consists of 26el DJ9BV yagi for 435 MHz, 2 x 37el DL6WU yagi for 1.3 GHz and a 750mm offset fed dish for 2.4 GHz

The next photograph shows the 2.4 GHz dish and helix feed system (note the anti-bird protection).



The photograph below shows the inside of the 2.4 GHz LNA box. The SMA relay in the top left corner allows the antenna to be used for transmitting purposes. The LNA itself is on the right hand side. It's a [DB6NT](#) design using an NE42484 followed by an MGA86576. This was assembled from a kit that I purchased from [Eisch Electronic](#) in Germany. Noise figure is quoted as being better than 0.6 dB.

The total gain of the 2 stage amplifier is >35 dB, so its possible to use lossy coaxial cable between the LNA and the downconverter. I use 23m of RG214 coax, which has a loss of approximately 17 dB at 2.4 GHz.



My L band uplink system consists of a homebrewed 23cm transverter with a Mitsubishi M57762 hybrid amp producing about 15watts. Experience to date is that I need between 3 and 6 dB more up-link ERP. Whilst I have a 7289 tube amp for 23cm, but found that having to retune from 1296 MHz to 1269 MHz every time was a nuisance. Plan B is to build a 30-40 watt transistor amplifier and tower mount it, thus reducing the feed-line losses.

New changes to newsletter

The newsletter is now being written in Microsoft Word which enables me to import and export files easier than when using Microsoft Home Publisher. If you wish to have articles in Word format, for republishing in other newsletters please contact me.

I also embed hyperlinks, so that when viewing the newsletter one can click on certain underlined blue words to go to websites. For example

Wellington VHF Group Inc is linked to www.vhf.d2g.com

Auckland VHF Group Inc is linked to www.qsl.net/zl1bq

Seti League Info

The Seti League now has articles previously published by H. Paul Shuch N6TX in QST, QEX, Ham Radio, 73, CQ and CQ-VHF. These are in PDF format and are available from http://www.setileague.org/articles/hps_ham.htm

H. Paul Shuch is the Executive Director of the **Seti League Inc**

At the website there is of course a lot of information regarding SETI (Search for Extra-terrestrial Intelligence) and it's technical aspects.

Thanks Scott ZL1KB

Rain Scatter

I mentioned rain scatter in the Beacons section and a search on Weather Doppler Radar using the Google search engine proved to be very interesting. In New Zealand there appears to be 3 operational units. One near Auckland, Wellington and Christchurch. Essentially the Doppler radar transmits a signal, then receives the reflected signal scattered off the rain. Basically the level of reflection determines the rain intensity and the Doppler on the signal gives the direction of the rain (due to winds). The results are then processed then overlaid on a map of the area. See <http://www.metservice.co.nz/radar/index.asp>.

Rainscatter is used extensively overseas for many long range 10 GHz contacts.

The GippsTech VHF+ Conference 2002

Peter Loveridge ZL1UKG attended the GippsTech VHF+ Conference 2002 recently and the following is his impressions of the event.

The Gippsland-based WIA Eastern Zone Amateur Radio Club organised the conference again at the campus of Monash University, Churchill, near Morwell. Accommodation at the Hotel/Motel was about a 10 minute drive from the campus. 12 speakers on a wide variety of topics gave well informed presentations of methods and theory that related well to the higher bands.

Doug McArthur VK3UM New EMR requirements

The Australian regulatory body, the ACA has been discussing guidelines for safe distance from antennas for all types of use. Using recently developed windows-based software the details of typical antennas can be entered to give the bore-sight and off-axis safe distances for any installation. Typical examples were worked through to show what to expect in one's own situation.

John Clark VK2TK Speech Acoustics and Intelligibility

Approaching from the physicist's and psychologist's point of view, the characteristics of speech were examined in relation to the pass-band of filters. Synthesis of speech was illustrated with .WAV files. Directions for future research were proposed where 600-800 Hz bandwidth may prove satisfactory.

Rex Moncur VK7MO WSJT meteor scatter experiences

The basic mechanism of the WSJT FSK441 mode was explained and its application to short bursts of enhanced propagation was demonstrated. The ability to read signals down to 27 dB below the noise showed that computer enhancement can retrieve contacts that used to not be there.

Mike Farrell VK2FLR Using JT44 for tropospheric and EME propagation

JT44 is quite musical in a warbling way. Averaging of lots of repeats also lends itself to recovering signals from well below the noise. Here long averaging periods recover the repetitive nature of signals from the noise.

Bob Demkiw VK2TG Analysis of contacts with a basic VHF/UHF station

The ARRL publish a graph in the The ARRL Antenna Handbook (1988 edition) showing expected propagation distances for given power and antenna gain. Bob had kept a log and compared two years results against each other and the published graph. The results were in good agreement with the manual although there were fewer signal reports from the larger distances. This method does rely on the distant operator giving an honest assessment of signal level.

Bryan Ackerly VK3YNG Solving noise problems in modern radio systems

Modern radios often have microprocessor control which introduces noise that may interfere with the front end RF performance. Using a work project case study, the characteristics of fast logic, SMT capacitors and multi-layer PCBs were investigated with modelling (Ansoft Harmonica v6.5) and a Network analyser. See www.compliance-club.com as a source of information.

Brian Tideman VK3BCZ Predicting E's propagation

Some of the history of study of "Sporadic E" propagation were presented eg QST, Nov 97 by Whitehead. The expected path lengths and locations were outlined along with factors that could indicate a lift in propagation was imminent.

Doug McArthur VK3UM The VK3UM 10m dish installation

A detailed set of photos on Power Point showed the project from beginning to end. Accurate control of such a large dish required a good understanding of the engineering to be learned along with a lot of labour. The tower base is rotated by a Centurian Tank turret ring gear with electric motor and elevation is controlled by hydraulic rams. The shack is directly underneath the tower fed with substantial heliax.

Dinner at the Café Gaztronomy, Morwell

3 courses from a set menu for a fixed price, BYO, inventive menu, well presented.

Neil Sandford VK2EI Integrating a 10 GHz 1W PA with a 0.65m offset dish

A Qualcom OmniTrack surplus power chain from the San Diego Microwave Group delivered 1W into a short horn to a TVRO surplus dish. Calculation and measurement had resulted in a slight change in position of the feed to level with the rim of the dish rather than about 4cm below. Design changes in the OmniTrack uplink amplifier at 14 GHz have resulted in later units not being usable on 10 GHz, so they are becoming less available.

Peter Loveridge ZL1UKG Basic measurements at UHF and above

With the emphasis on low cost, hence affordable, the use of attenuators, an HP 432 power meter, directional couplers and a sweep generator were discussed. Practical examples included antenna pattern evaluation, cable run checking, microwave power measurement, dish feed return loss, "no-tune" filter adjustment and the development of a 10 GHz dish feed with demonstration.

Neil Sandford VK2EI Utilising a 24 GHz 0.5W Milliwave PA

US surplus was the source of the Milliwave PA, but using it required building waveguide matching components and coaxial transition. Methods giving required accuracy were illustrated.

Brian Thomas VK2AMT The next generation of Radio Telescope, 1km square array

This is an internationally funded science project proposal with Australia putting up about 10% of AU\$1000,000,000. The requirement that a location must meet and the pattern of interferometer locations was explained.

Peter Ward AX2VCI A variety of unusual antenna designs and software.

Presented during breaks between speakers

A number of 5 to 15 minute presentations of different antennas, not found in Ham Handbooks were shown to stimulate interest. Jasik (Antenna Engineering Handbook, 1st edition) was quoted a number of times. This can be frustrating when the exact name or chapter is not quoted as well. The examples of slotted cable for SWR investigation and simple but unusual properties being made use of was all too brief. Bring on the proceedings! 4 Excel spreadsheets developed by Peter are available from www.qsl.net/wb6tpu/swindex.html developed to assist in calculations with antennas.

Lunch

The participants met up and made their way home. Attendance this year was 106 including 20 partners with visitors from VK1, VK2, VK3, VK4, VK5, VK7 and your correspondent from ZL, drawn by the growing reputation of the conference. The federal president and VK3 president came along to see what went on. Let us hope to see wider publicity and support in future years.

Trading in useful microwave components carried on during the breaks, and a number of home construction projects were on display to inspire the visitor. Proceedings are hoped to be available by 12/2002.

Peter Loveridge ZL1UKG 10 July 2002

Copies of the Proceedings from the 2001 Conference are available. Cost is ~ A\$20.

Back copies of previous Proceedings are also available at A\$10 each plus A\$5 P&P per package.

Limited Copies (3 only - email first!!) of 1998.

Plenty of 1999, 2000. Send request as above, email queries to peter.freeman@sci.monash.edu.au

Forward a cheque or money order to:

WIA Eastern Zone Amateur Radio Club (Inc)

C/- PO Box 273

CHURCHILL

Vic 3842

<http://www.qsl.net/vk3bez/> for further information

1152 MHz Oscillator.

Kevin Murphy ZL1UJG

I am writing an article on a oscillator using a 64 MHz clock oscillator module, but due to debugging the circuit, and an extra dose of a cold, I am behind schedule. Therefore the partially completed article was removed from this newsletter, so that the newsletter could be distributed. This allows more time for debugging the unit.

Editor The editor is always looking for small technical or operational items for the newsletter. Is there any news from the last contest? What bands are you active on? Are you building equipment for any band? Photos of equipment, etc.

[Thank you to those people who have sent items for the newsletter](#)